

REMARKS:

REMARKS REGARDING CLAIMS AMENDMENTS:

Amendment of claim 5 removes the number "25."

Claims 1 and 9 have been amended to clarify that the relationship (B/R) of radial extent or width to brake-disc radius affects the number of modes of band shaped wear. Support for the amendment of claim 1 and claim 9 exists in paragraphs [0010] - [0024] of the published version (U.S. 2004/0129509 A1) of the present application. Claims 1, 2 and 5 - 12 are pending in the present application.

IN RESPONSE TO THE OFFICE ACTION:

REJECTION UNDER 35 U.S.C. § 103(a):

Claims 1 - 2 and 5 - 12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Dagb et al (U.S. 5,568,846) in view of Tasker et al. (U.S. 5,855,416) further in view of Cooper et al. (WO 99/19525) and Wirth (DE 4133593) or Kappich (DE 19507102) and two Math Forum articles.

Careful reading of the Office Action mailed on December 10, 2004 reveals that it is essentially the same as the Office Action mailed on April 30, 2004, which was addressed in full in the response filed on September 30, 2004. Additional information in the Office Action indicates that the Examiner was not convinced by arguments presented in the response of September 30, 2004.

In the prosecution thus far, several key issues are summarized below and are discussed according to their affects on individual claims. These issues are:

- a) A brief summary of the combined references applied to each of the claims pending in the instant application;
- b) Failure of the Office Action to provide a *prima facie* case of obviousness; and
- c) Specific focus on the purported basis for claims rejection.

SUMMARY OF THE REFERENCES AND APPLICATION TO PENDING CLAIMS

The following summaries of the references represent an abbreviated form of more detailed information that is available in the response filed on September 30, 2004.

United States Patent (US 5,568,846) to Dagħ et al. shows a brake disk¹ that provides a “non-circular cross-section region with closely spaced V-shaped ridges and troughs, (such that) the level of the radial fracture stresses on the disc as well as the shear and bending stresses on the shaped region can be maintained at an acceptable level” (Column 2, lines 3 - 10).

US 5,855,416 (Tasker) teaches “a reinforced vehicle axle housing assembly for rear disc brake adaptation on a heavy duty vehicle” (Column 1, lines 34 - 36). Reinforcement is achieved using a “360° weld along with a sleeve insert” (Column 5, line 60 to Column 6, line 7).

WO 99/19525 (Cooper) teaches disc brake performance based on the composition of the disk rotor.

DE 4133593 (Wirth) refers to uneven wear of the brake disk and discusses a lining for rail vehicle brakes comprising a friction element attached to a backing plate, for universal use with different disc caliper arrangements. The friction face of the element takes the form of a circular annulus having optimum wear characteristics when the arc length (l) of a friction element is related to the friction element radius (r) according to the following equation:

$$l(r)/2r = \text{Constant}$$

DE 19507102 Kappich teaches reduction of screeching or squealing of disc brakes by brake pad length adjustment.

The Math Forum @ Drexel presents mathematics of circular measurement.

Applicants perceive that rejection of claims 1, 2 and 5 - 12 of the present invention under 35 U.S.C. §103(a) needs to rely upon seven references in a combination that includes at least those of Dagħ et al., Tasker, Cooper, Wirth and two mathematical treatises identified as the “Math Forum @ Drexel.” These references are particularly disparate in their subject matter. The

¹ Throughout the following discussion the alternative spellings “disk” and “disc” are used interchangeably.

Office Action is not particularly clear as to how these combined references provide basis for rejection of any limitations of claims of the present invention for obviousness.

After citing only one specific portion (Tasker, Column 5, line 60 to Column 6, line 7) that deals with use of a 360° weld for securing a brake flange (see above), the Office Action asserts that one of ordinary skill could arrive at the present invention by experimentation. It is apparent that the Examiner failed to identify the intended target for experimenting using cause effective variables. This is evidence to Applicant that the Examiner has not understood that the relationship between radial extent of the brake lining and the radius of a brake disk or rotor according to the present invention leads to a reduction in oscillating band shaped wear, which effect may be varied with variation of the B/R ratio.

A comparison of pending claims and teachings drawn from eight cited references will now be presented to provide evidence that the present invention is not obvious over the combined references.

1. (Currently Amended) Disc brake for a heavy vehicle having an axle pressure between 6 and 14 tons, comprising a disc-shaped rotor (8) consisting of a cast iron alloy and having a radius R and a caliper (32) supporting a brake lining (32) which is intended to be pressed against said rotor (8) during braking, in which said rotor (8) and brake lining (32) are arranged to absorb a brake power corresponding to a braking torque between 12 and 25 kNm and in which said brake lining (32) has a radial extent B, characterized in that the ratio B/R between the radial extent B of the lining (32) and the radius R of the rotor (8) is less than 0.38 and thereby substantially limiting a number of band shaped wear modes.

The Office Action includes references that consider the need to modify brake pad design to reduce uneven wear over the surface area of the brake pad (Wirth) and to eliminate the annoyance of squealing brakes (Kappich). Wirth does not consider brake rotor characteristics, but instead teaches only reshaping of brake pads for universal use with differing arrangements of brake calipers to reduce uneven wear across brake linings of larger surface area. The reference teaches brake lining shaping according to the relationship, shown below, wherein l = the length of an arc of radius r .

$$l_{(r)}/2r = \text{Constant}$$

Kappich teaches reduction of the resonant frequency of squeaking of brakes based on a ratio of the length (L1) of the lining to the circumference (U) of the disc. The linings form band-pass filters for the characteristic resonances of the disc.

Wirth and Kappich and the Math Forum articles are silent concerning the B/R ratio and the phenomenon of band shaped wear according to the present invention.

COMPARISON OF CLAIMS WITH THE COMBINED REFERENCES?

Regarding claim 1, as indicated above, none of the references teach or suggest the B/R ratio that, when varied, causes changes in band shaped wear of a brake rotor leading to fatigue of the metal of the rotor. Further, the references fail to teach limitation of modes of band shaped wear according to amended claim 1. Band shaped wear is associated with only a portion of the surface area of a brake lining, during braking, and is different from uneven wear according to Wirth (see above).

Claim 2 relates braking torque from about 16 kNm to about 25 kNm to the radial extent (B) required for a brake lining (32); i.e., from less than 70mm to less than 80 mm. By radial extent, it is meant that the distance from the inner edge to the outer edge; i.e., the width of the brake lining (see Figure 5 and paragraph [0010] of the published application). The references (Wirth and Kappich) teach length variation, not width variation, of a brake lining and are silent regarding specific dimensions or any relationship between braking torque and radial extent of a brake lining.

Claim 5 further requires that under the constraints of braking torque recited in claim 2, “the wear surfaces of the brake disc remaining flat when heated.” It is respectfully urged that claim 5 is allowable for the same reasons asserted with respect to claim 2 from which it depends, as well as in view of the further limitations contained therein.

Claim 6 depends from claim 2 and adds the limitation that the brake is configured so that “the radius of the rotor (8) is greater than 185 mm.” None of the cited references teach, suggest or disclose such a limitation.

Claim 7 further limits the brake lining (32) of claim 2 to one “having a tangential modulus of elasticity E greater than 400 Mpa at a contact pressure of 2 MPa at room temperature.” Again, none of the references, alone or in any appropriate combination, teach, suggest or disclose such a requirement for a brake lining.

Claim 8 recites that the caliper (30) of Claim 2 supports two brake cylinders which are meant to press the brake lining against the rotor.

Claim 9, as amended, is limited by the ratio B/R and reduction of modes of band shaped wear to preferably a single mode. None of the references either teach or suggest these limitations

Claims 10 - 12 depend from claim 9 adding limitations thereto for options relating axle pressure to radial extent (B) of brake linings. Such relationships are not found in the cited references. The improvement of claim 9 is believed to be patentable to place dependent claims 10-12 also in condition for allowance.

FAILURE OF THE OFFICE ACTION TO PROVIDE A PRIMA FACIE CASE OF OBVIOUSNESS

Failure of the previous Office Action (April 30, 2004) to provide a *prima facie* case of obviousness as a basis for rejecting claims of the present invention was argued in the Response filed on September 30, 2004. However, the Office has issued the present Action with similarly worded paragraphs as included in the previous Office Action of December 10, 2004, but has failed to acknowledge or address Applicants responsive argumentation. Now additional argumentation has been proffered in support of the claims and substantive comment on such argumentation is respectfully solicited in the responsive Action.

Applicant reasserts the position that the requirement and burden of presenting of a *prima facie* case of obviousness under 35 USC §103 has not been met. Therefore applicants request reconsideration and withdrawal of rejection of claim 1, 2 and 5 - 12 under 35 USC §103(a).

THE PURPORTED BASIS FOR CLAIMS REJECTION

The Office Action is incorrect when stating that, “the claims are directed to inter alia, essentially the ratio between the radius of a brake rotor and the radial extend or length of a braking lining for a disk brake,” As clarified in the response of September 30, 2004, the radial extent is representative of the width of the brake lining as shown in Figure 5, and described in paragraphs [0010] and [0011] of published application U.S. 2004/0129509 A1.

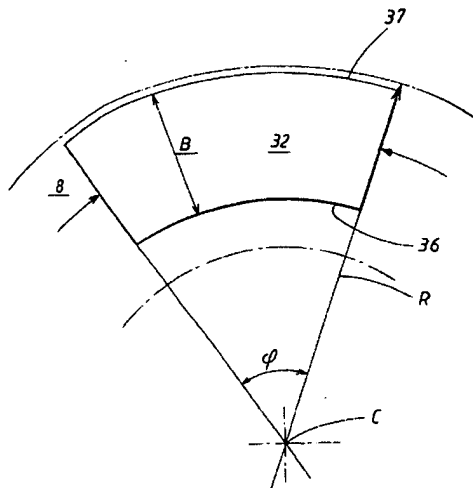


FIG. 5

[0010] To aid understanding of the invention, the following theoretical background is provided: Trials have been conducted involving brake tests in a test bench for brake discs and brake linings of different proportions. Observations show that brake linings having a small radial extent, B, are less prone to cracking. An explanation of this is that the relationship between the width of the brake lining, from the inner edge of the brake lining in the radial extent to the outer edge of the brake lining in the radial extent, and a contact band formed owing to the irregularity of both disc and lining is more advantageous. This means that for a certain level of energy input to the disc brake, there is an optimal relationship between the width of the said contact or wear band w and the radial extent B of the brake lining. By radial extent is here meant the distance from the inner edge of the brake lining in the radial extent to the outer edge.

[0011] We introduce a relationship $\gamma=B/R$, in which B is constituted by the radial extent of the brake lining and R is the radius of the disc. In the tests which γ have been conducted, $\gamma=0.42$ for the wide lining and $\gamma=0.37$ for the narrow lining. The test showed that the narrow lining obtained a 33% longer working life, despite the fact that the disc was 3.8 kg lighter, which is negative from the cracking aspect since the disc becomes warmer.

By emphasizing brake lining length, rather than width, the references (Wirth and Kappich) teach away from the present invention.

In further rejection of claims of the present invention, the Office Action includes the statement, “Re the particular recognition by applicant that correlating the ratio between the brake lining extent or length and the radius of the brake rotor is significant, each one of the references to Wirth and Kappich recognizes the relationship and its significance. See MPEP 2144.05.”

Such a general statement is no evidence that the references Wirth and Kappich recognize such a relationship. However, in an attempt to understand the significance of Wirth and Kappich, Applicant has referred to the suggested portion of MPEP, which is reads as follows:

**2144.05 Obviousness of Ranges [R-1]
Only Result-Effective Variables Can Be Optimized**

A particular parameter must first be recognized as a result-effective variable, (emphasis added), i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) (The claimed wastewater treatment device had a tank volume to contractor area of 0.12 gal./sq. ft. The prior art did not recognize that treatment capacity is a function of the tank volume to contractor ratio, and therefore the parameter optimized was not recognized in the art to be a result-effective variable.). See also *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) (prior art suggested proportional balancing to achieve desired results in the formation of an alloy).

Applicants submit that MPEP 2144.05(B) does not apply to the present invention since the references do not recognize the parameter of “radial extent (B)” as a result effective variable. The Office Action admits to this by selecting “length of a brake lining” as a result effective variable (see above). Also, neither Wirth nor Kappich teach the result of variation of modes of band shaped wear associated with varying parameter B.

Another erroneous statement found in the Office Action wrongly identifies the result of varying the B/R ratio, as follows:

“It appears that the ratio is a result-effective variable which when optimized achieves a desired result of at least reduced vibration or resonance (emphasis added). It would have been obvious to modify Dagb et al. as modified by routine experimentation to optimize the ratio of B/R as per Wirth or Kappich - - .”

In the present application, band shaped wear pattern is modified by variation of the ratio of radial extent or width (B) of the brake lining with the radius of the brake disc (R). Expectation of this variation to affect brake vibration or resonance indicates a lack of appreciation of the inventive concept of the present application. Since Wirth and Kappich fail to mention either radial extent (B) or its ratio with brake disc radius (R) “experimentation to optimize the ratio of B/R as per Wirth or Kappich” is not possible.

The Office Action further states “- - - the brake torque, modulus or elasticity and any variety of parameters typically known, calculated or estimated by a brake artisan to arrive at the most suitable disc brake for the environment and application at hand with reduced vibration.”

As discussed above, this statement also wrongly identifies vibration as the expected result affected by change of B/R ratio. The Office Action contains no evidence showing how a brake artisan might arrive at the present invention using variables of brake torque, modulus of elasticity and other parameters. Regardless of this omission, it is reasonable to expect evidence of these parameters in references used as a basis for rejection. Wirth and Kappich are silent regarding limitations presented by claims 2, 7, 10 and 11 of the present invention.

Although the Examiner’s intention is unclear, Applicant also referred to MPEP 2144.04 under “Changes in Size/Proportion.” It was concluded that decisions affecting *In re Rose*, (220 F.2d 459, 105 USPQ 237 (CCPA 1955)); *In re Rinehart*, (531 F.2d 1048, 189 USPQ 143 (CCPA 1976)) and *Gardner v. TEC Systems, Inc.*, (725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984)), were dependent upon previous disclosures differing from these specific cases only in terms of size/proportion. A clarifying statement in MPEP 2144.04 includes, “- - - the Federal Circuit held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.” The selected section of MPEP 2144.04 does not presently apply since the present invention did not exist previously and cannot be subject to determination of differences from the prior art.

The Office Action indicated need for the instant specification to present a statement or evidence that a series of tests and observations provides claimed selections that are critical.

MPEP 2144.05(III) states, “Applicants can rebut a *prima facie* case of obviousness based on overlapping ranges by showing the criticality of the claimed range. “The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.”

The references are silent regarding the present invention and overlapping ranges. It is not necessary to show criticality of claimed selections because the effect of selected variables on band shaped wear is absent from the prior art.

The following statement regarding applicants' previous arguments is included for convenient reference:

7. Applicants' arguments in the amendment filed Sept. 30, 2004 have been considered but are not convincing for the above reasons. The claims are directed to a disk brake wherein the "ratio B/R between the radial extent B of the lining (32) and the radius R of the rotor (8) is less than 0.38." As stated above, one having ordinary skill in the art through routine experimentation would select any variety of ratios based upon the type of rotor, brake pad, etc. in order to arrive at the optimum ratio.

In this statement, there is evidence that the Examiner apparently disregarded portions of the previous response (09/30/04) which showed that the present invention is not obvious over the references. Lacking evidence from the references, it appears that rejection of claims of the present invention is attributable to an artisan who lacks information and knowledge of both the result desired and variables that cause change in the desired result (emphasis added). Without knowledge of either the problem or tools to solve the problem, it is most unlikely that even the most skilled artisan would arrive at the improvement in band shaped wear according to the present invention.

The Examiner's assertion of experimental optimization to arrive at the present invention overlooks the fact that no evidence exists in the references concerning radial extent (B) and modes of band shaped wear according to the present invention. Optimization, the purported basis of rejection, lacks support from the references. Serendipitous discovery of the present invention by one of ordinary skill in the art seems highly unlikely.

Applicants have made an earnest attempt to respond to all the points included in the Office Action and, in view of the above, submit again that the requirement and burden of presenting of a *prima facie* case of obviousness under 35 USC §103 have not been met. This response addresses pending claims individually and was developed in sufficient detail for use on appeal, should the Examiner maintain the present rejection of the claims. Therefore, request is

Serial No.: 10/605,598
Confirmation No.: 2597
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Atty. Ref.: 00173.0043.PCUS00

respectfully made for reconsideration of the application and notification of allowance of claims 1, 2 and 5 - 12 in the next paper from the Office.

The undersigned representative requests any extension of time that may be deemed necessary to further the prosecution of this application.

The undersigned representative authorizes the Commissioner to charge any additional fees under 37 C.F.R. 1.16 or 1.17 that may be required, or credit any overpayment, to Deposit Account No. 14-1437, referencing Order No. 00173.0043.PCUS00.

In order to facilitate the resolution of any issues or questions presented by this paper, the Examiner should directly contact the undersigned by phone to further the discussion.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Tracy W. Druce", written in a cursive style.

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